

The nucleus of thorium-229 possesses a property that is unique among all known nuclides: It should be possible to excite it with ultraviolet light. To date, little has been known about the low-energy state of the Th-229 nucleus (denote as ^{229m}Th) that is responsible for this property. Together with their colleagues from Munich and Mainz, researchers at the Physikalisch-Technische Bundesanstalt (PTB) have now performed the first-ever measurements - using optical methods - of some important properties of this nuclear state such as the shape of its charge distribution, its magnetic dipole and electric quadrupole moments. In this way, a laser excitation of the atomic nucleus can be monitored, thus allowing an optical nuclear clock to be realized that "ticks" more precisely than present-day atomic clocks. The scientists have reported their results in the *Nature*, issue from 19 April 2018.

Among 9 authors of this publication, there was Dr. Eng. Przemysław Głowacki, an employee of the Faculty of Technical Physics at the Poznan University of Technology, who in 2015-2017 held his PostDoc position at PTB. The other authors (in addition to the PTB group) came from the following research centers: Ludwig-Maximilians-Universität München (LMU), Johannes Gutenberg University Mainz (JGU), the Helmholtz Institute Mainz (HIM), and GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt.

More information on the optical nuclear clock and its properties can be found in the following sources:

- 1) J. Thielking, M. V. Okhapkin, P. Głowacki, D. M. Meier, L. v. d. Wense, B. Seiferle, C. E. Düllmann, P. G. Thiolf, E. Peik: Laser spectroscopic characterization of the nuclear clock isomer ^{229m}Th . *Nature* 556, 321-325 (2018): <https://www.nature.com/articles/s41586-018-0011-8>
- 2) E. Peik, Chr. Tamm: Nuclear laser spectroscopy of the 3.5 eV transition in ^{229}Th . *Europhys. Lett.* 61, 181–186 (2003)
- 3) L. von der Wense et al.: Direct detection of the ^{229}Th nuclear clock transition. *Nature* 533, 47-51 (2016): <https://www.nature.com/articles/nature17669>

The above story is based on materials provided by [Physikalisch-Technische Bundesanstalt \(PTB\)](#).

Photo label:

A team of researchers of PTB and LMU during research work in the Maier–Leibnitz Laboratory in Garching near Munich, belonging to LMU and Technical University of Munich TUM. From left to right: Lars van der Wense, Benedict Seiferle, Johannes Thielking, Maxim V. Okhapkin, Przemysław Głowacki.

Photo source: P. Głowacki - private gallery.